Quantifying the Climate Benefits of Low Impact Development (LID) in Urban California

State Water Board and the Water-Energy Climate Team Measure W-4: Urban Water Reuse Implementation Workshop

June 17, 2009

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Points to Cover:

- Low Impact Development (LID)
- Analysis of Potential Water Harvesting
- Estimates of Energy and GHG Benefits

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Low Impact Development

Potential Savings in Urbanized Southern California and SF Bay Area by 2020 (increasing each year thereafter):

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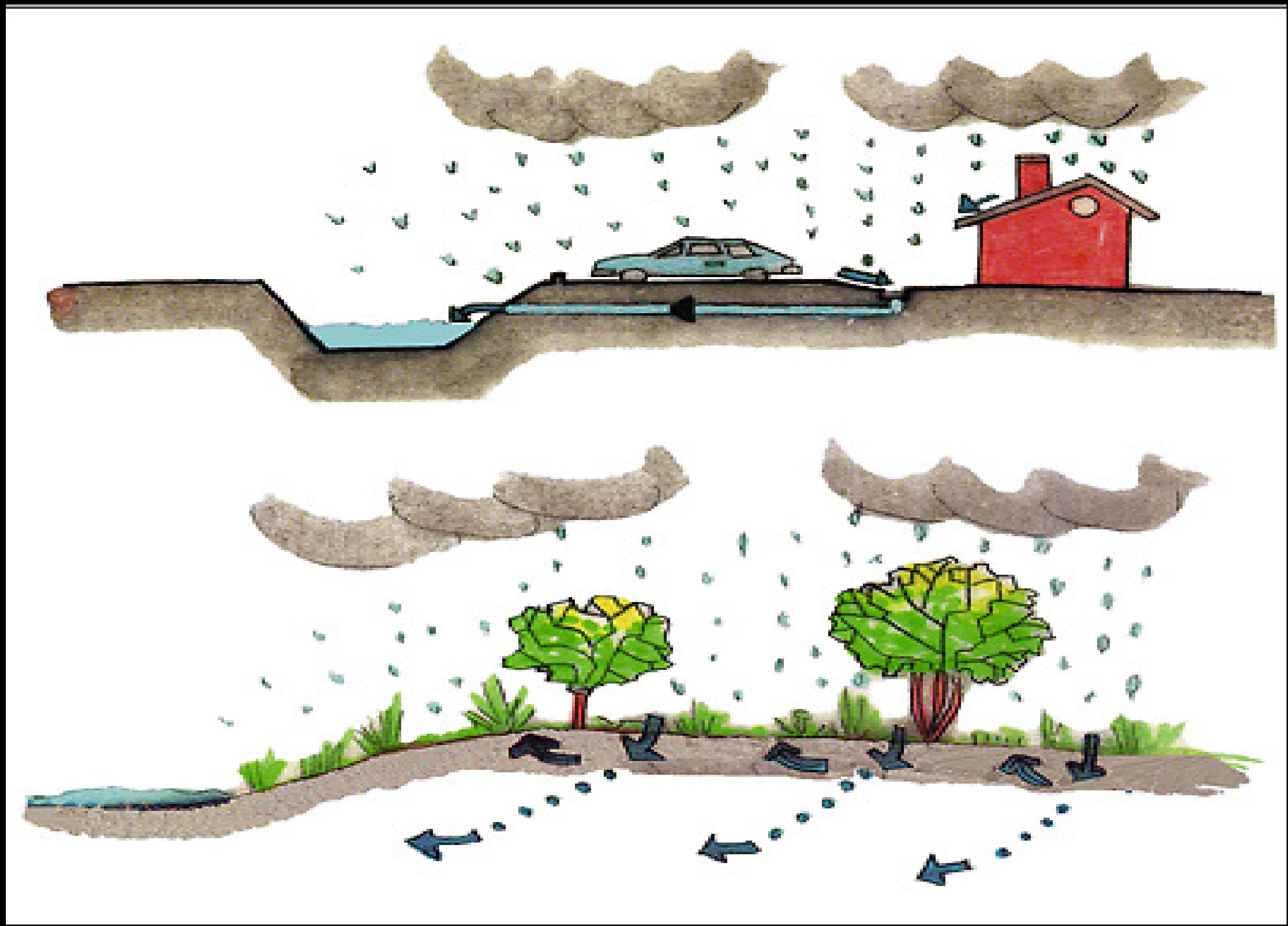
Low Impact Development

Equivalent to:

- Water for approximately 1,000,000 people
- Electricity for more than 56,000 single family homes per year
- More than 52,000 cars off the road annually

Impervious vs. Pervious Surfaces and Groundwater Recharge



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LID: Pollution Prevention & Water Quality

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Urban Stormwater Runoff: Impairment

Ballona Creek, Los Angeles (Califo
Commission)

Los Angeles River (City of Los Angeles)

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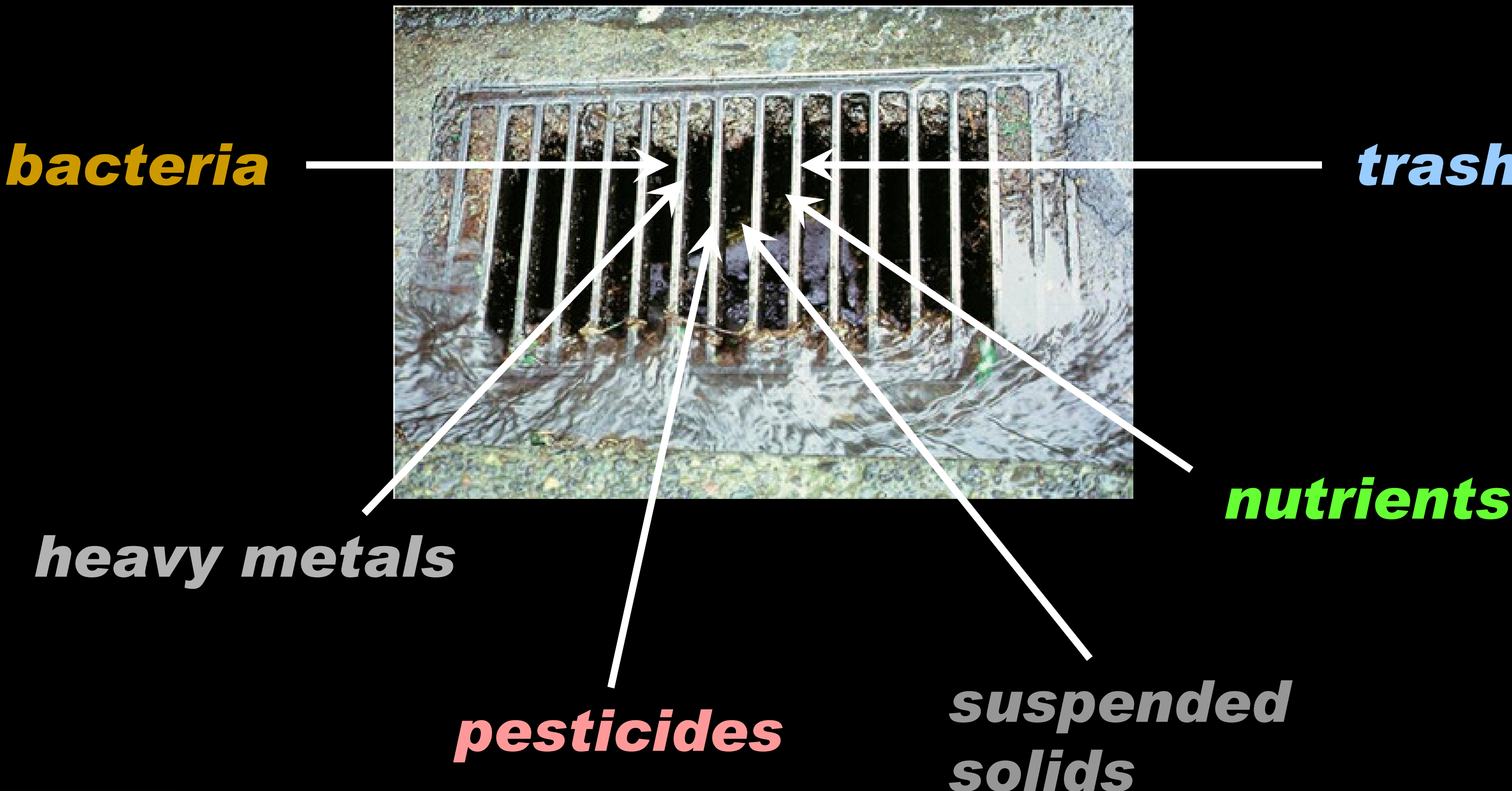
Urban Stormwater Runoff: Pollutants



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Urban Stormwater Runoff: Causes

(James Krumm)

(californiacanadi
ans.blogspot.com)

(transit-rider.com)

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LID for Water Supply

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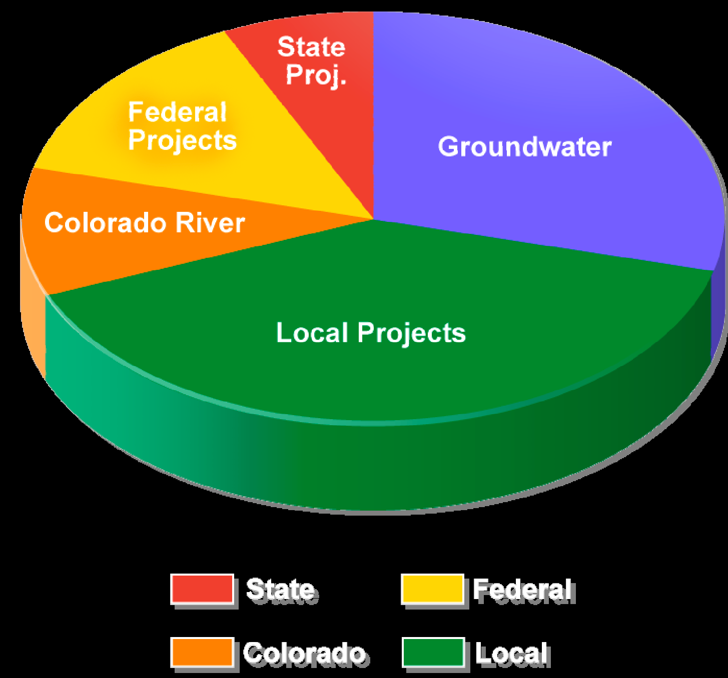
State Water Supply Sources



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Lester Snow, California
Department of Water Resources

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Montclair Basins

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Infiltration Islands

Courtesy of Bruce Ferguson

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Infiltration Islands

Courtesy of Low Impact Development Center

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Bioretention

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Rain Gardens

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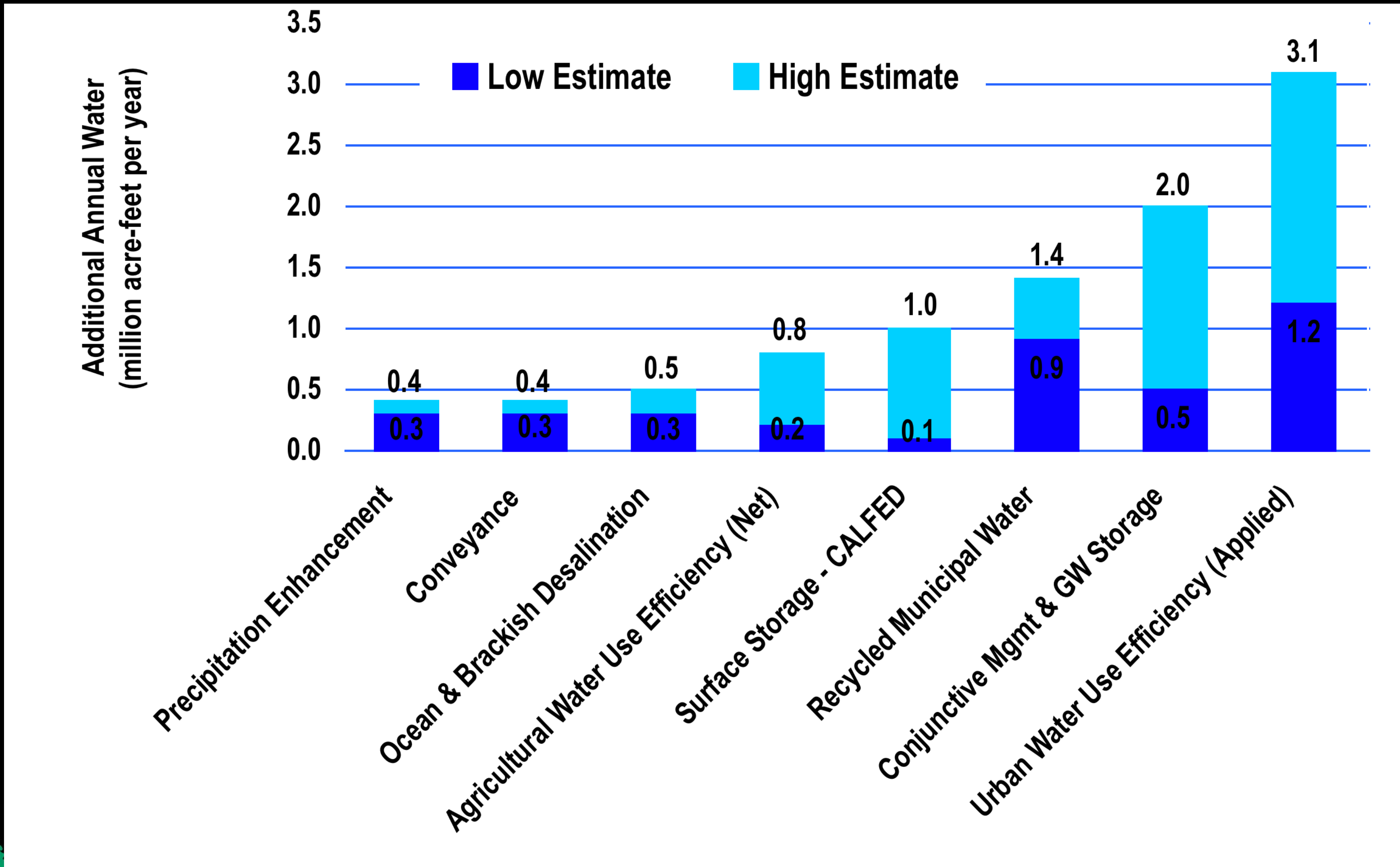
California Water Supply Options



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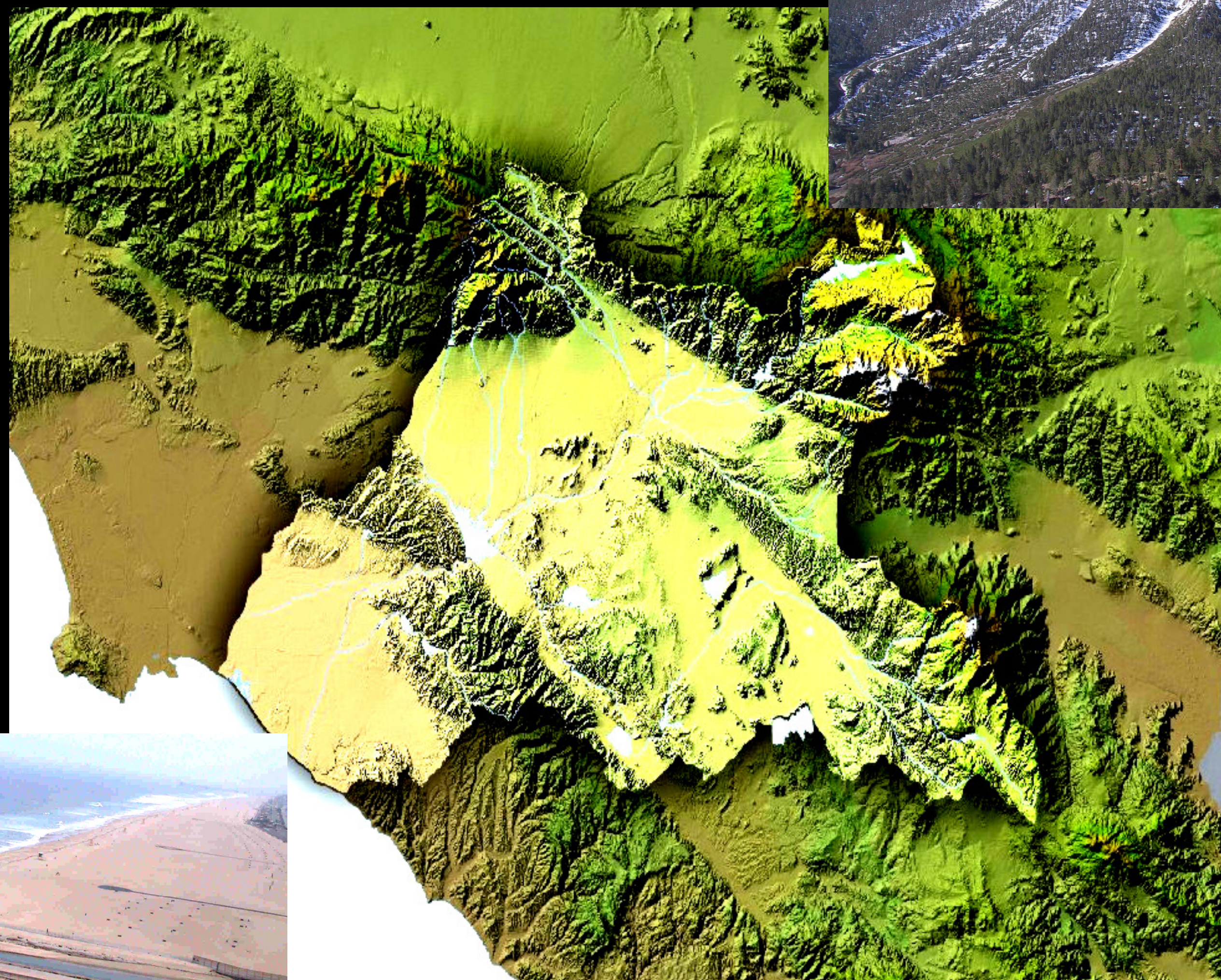
Santa Ana Watershed



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Santa Ana River at Riverside

Land Use in the Chino Basin

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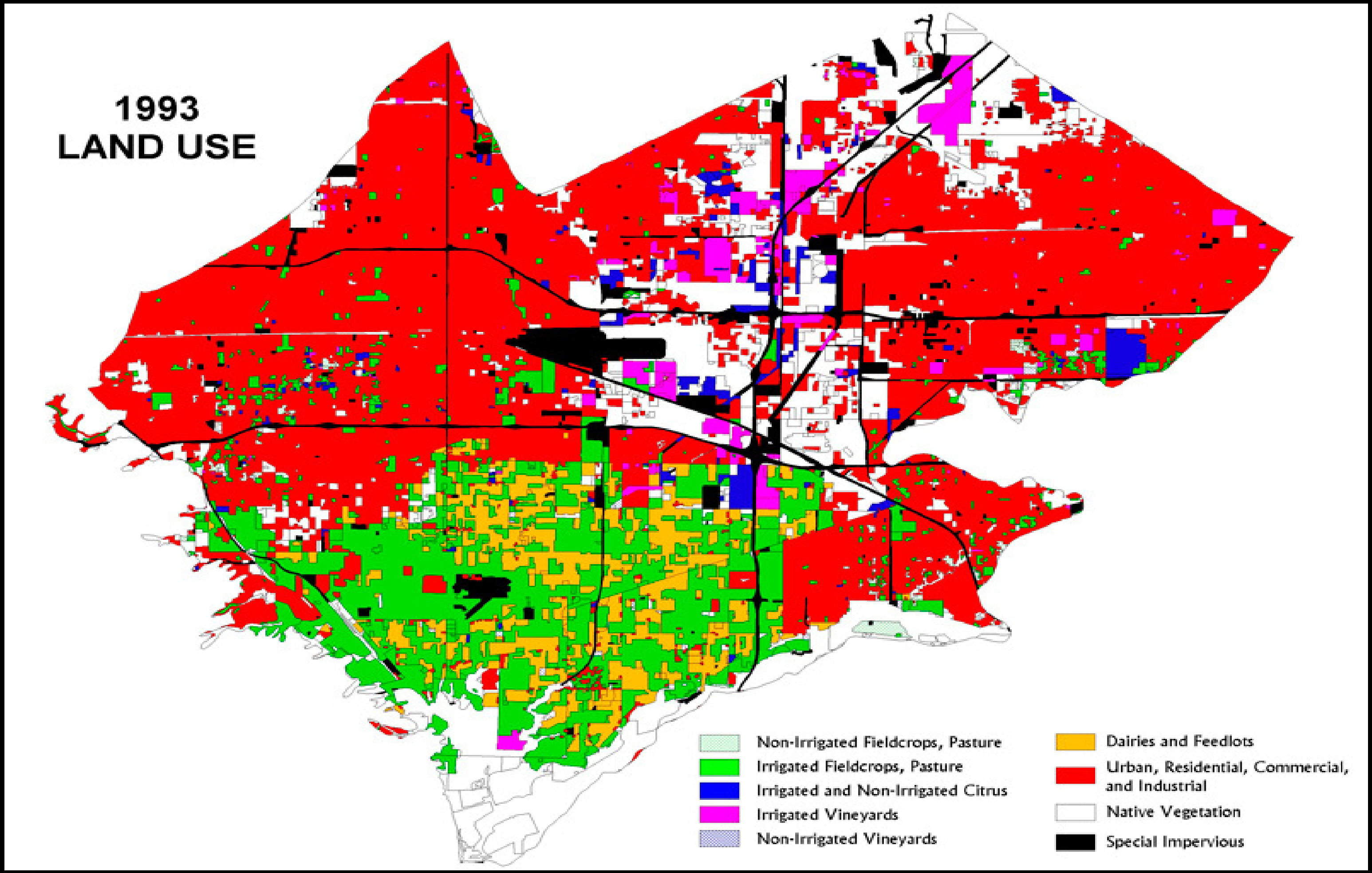
Land-Use in the Chino Basin



Wildermuth Environmental

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Stormwater Flows

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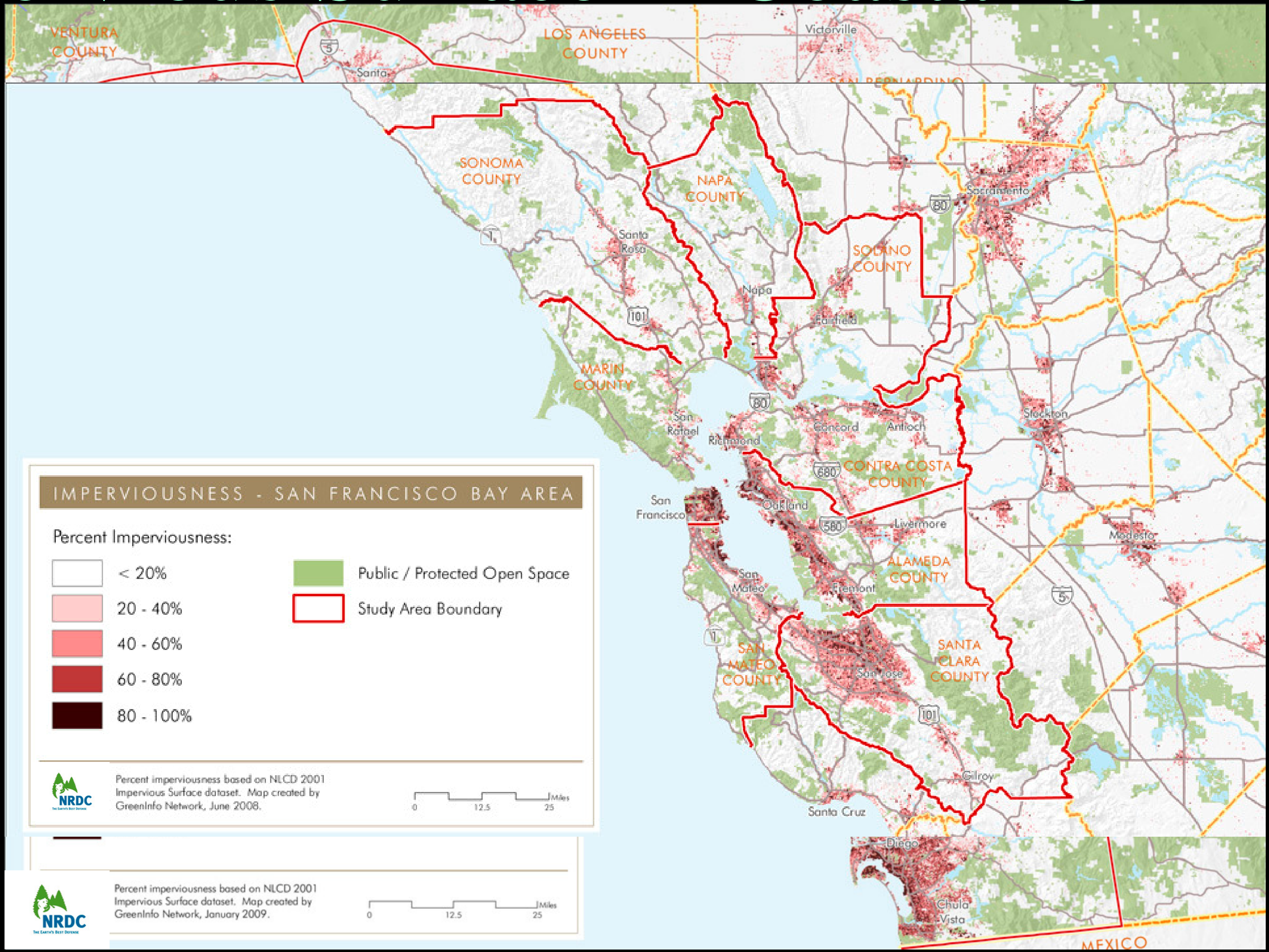
Impervious Surface in Coastal CA



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Impervious vs. Pervious Surfaces and Groundwater Recharge

City of Lincoln, NE, Watershed Management Division

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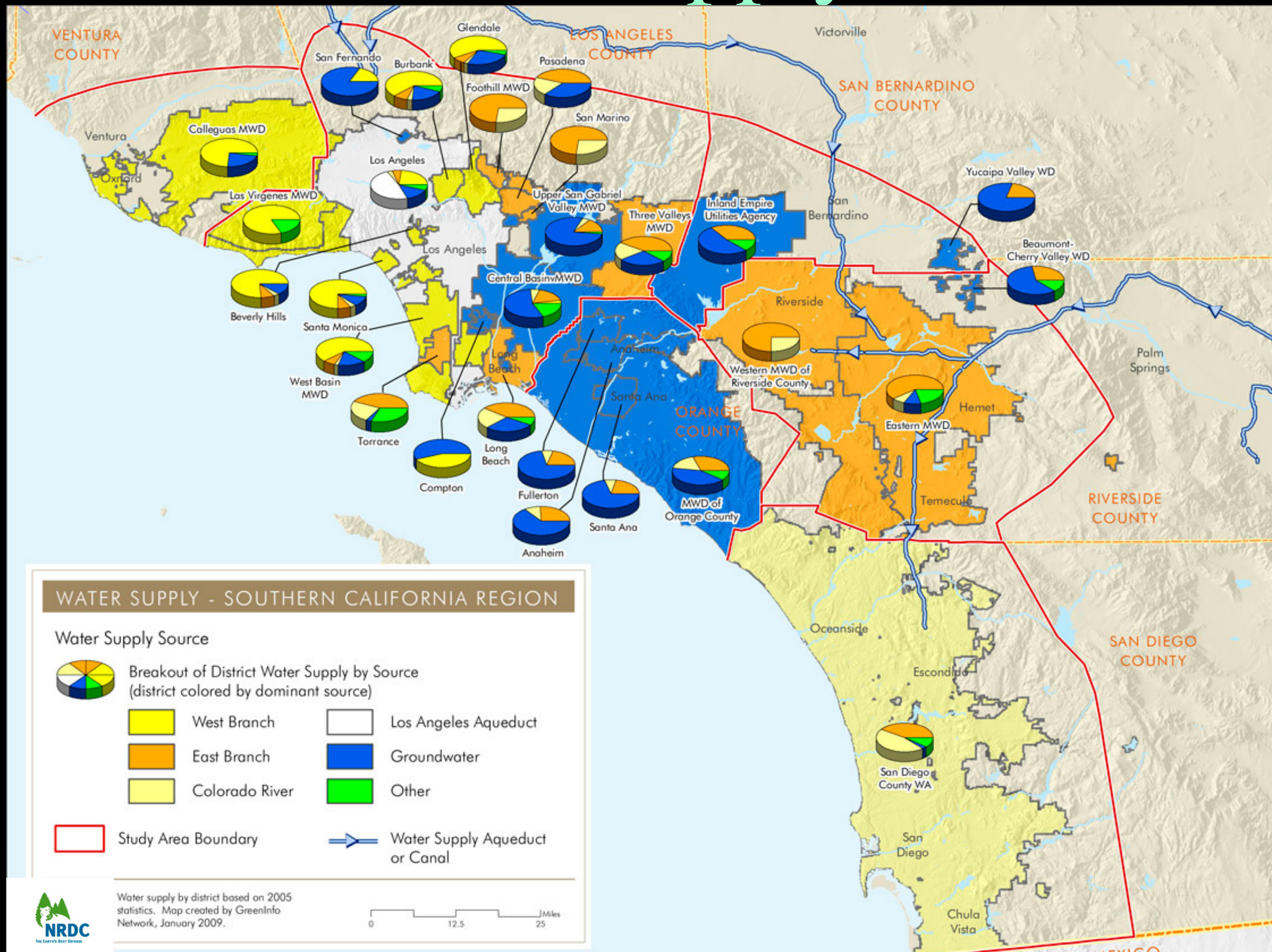
Sources of Water Supply



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Infiltration

City of Los Angeles

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Rain Barrels / Cisterns

EPA / Abby Hall

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Quantifying the Opportunity

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Steps in the Analysis

- Land Use: Existing percentage of impervious surface and projected development rate for commercial and residential land use.
- Infiltration potential based on soil permeability and availability of site open space.
- Annual precipitation.
- Current groundwater use and potential for aquifer recharge or capture and reuse.

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Constraints and Conservative Assumptions

• Includes only urbanized southern California and the San Francisco Bay Area; does not account for the rest of the state.

• Land Use: incorporates only commercial and residential development, and not industrial, government, public use, or transportation.

only new and redevelopment, with limited application to retrofitting. Does not include the existing built environment.

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Constraints and Conservative Assumptions

- Accounts for areas of shallow groundwater or existing groundwater contamination in assessing infiltration potential.
- Accounts for the effects of evapotranspiration on infiltration.
- Assumes that capture will harvest water from rooftop surfaces only.
- Does not consider loss rate from conveyance.

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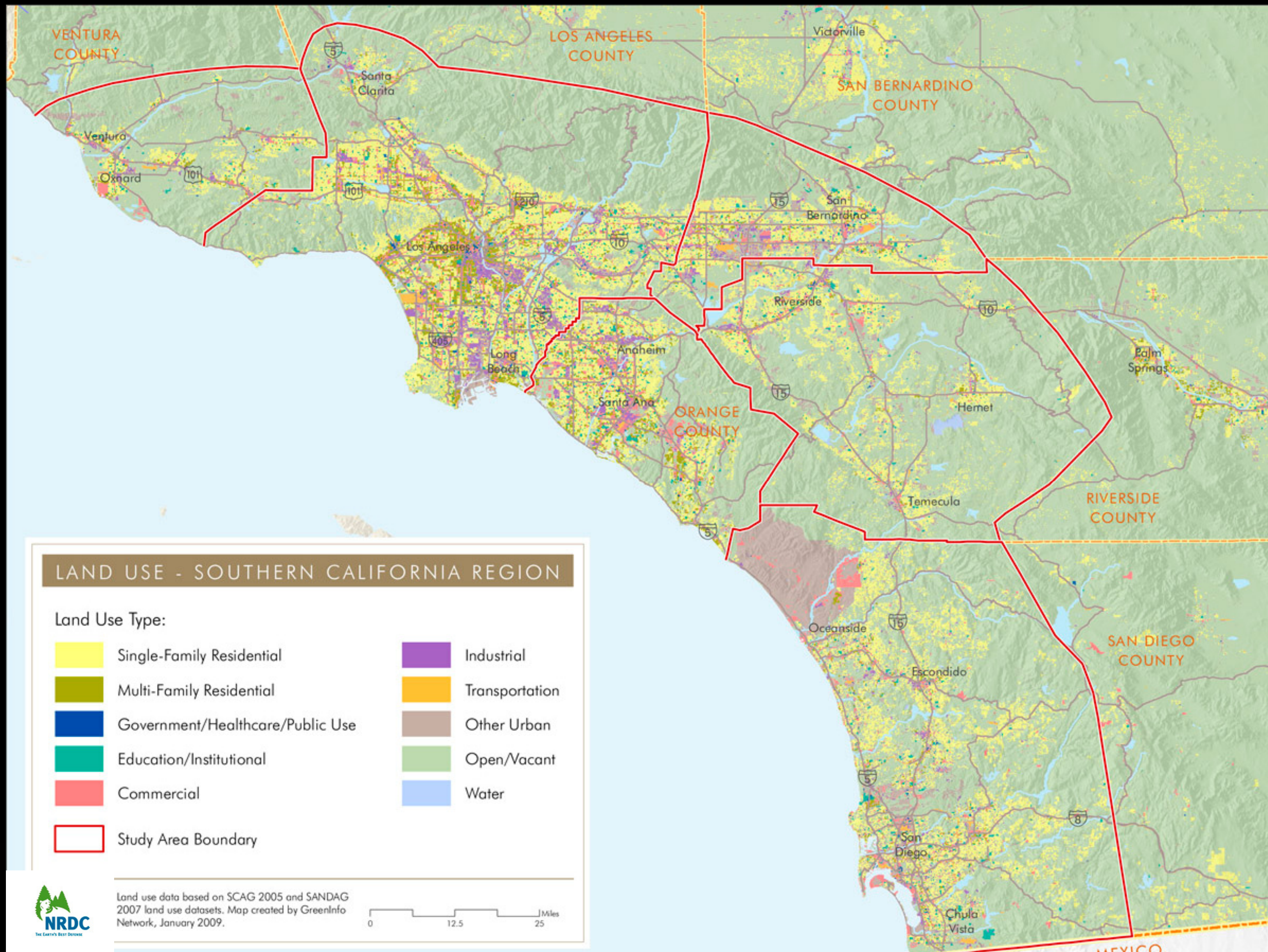
Land Use - Southern California



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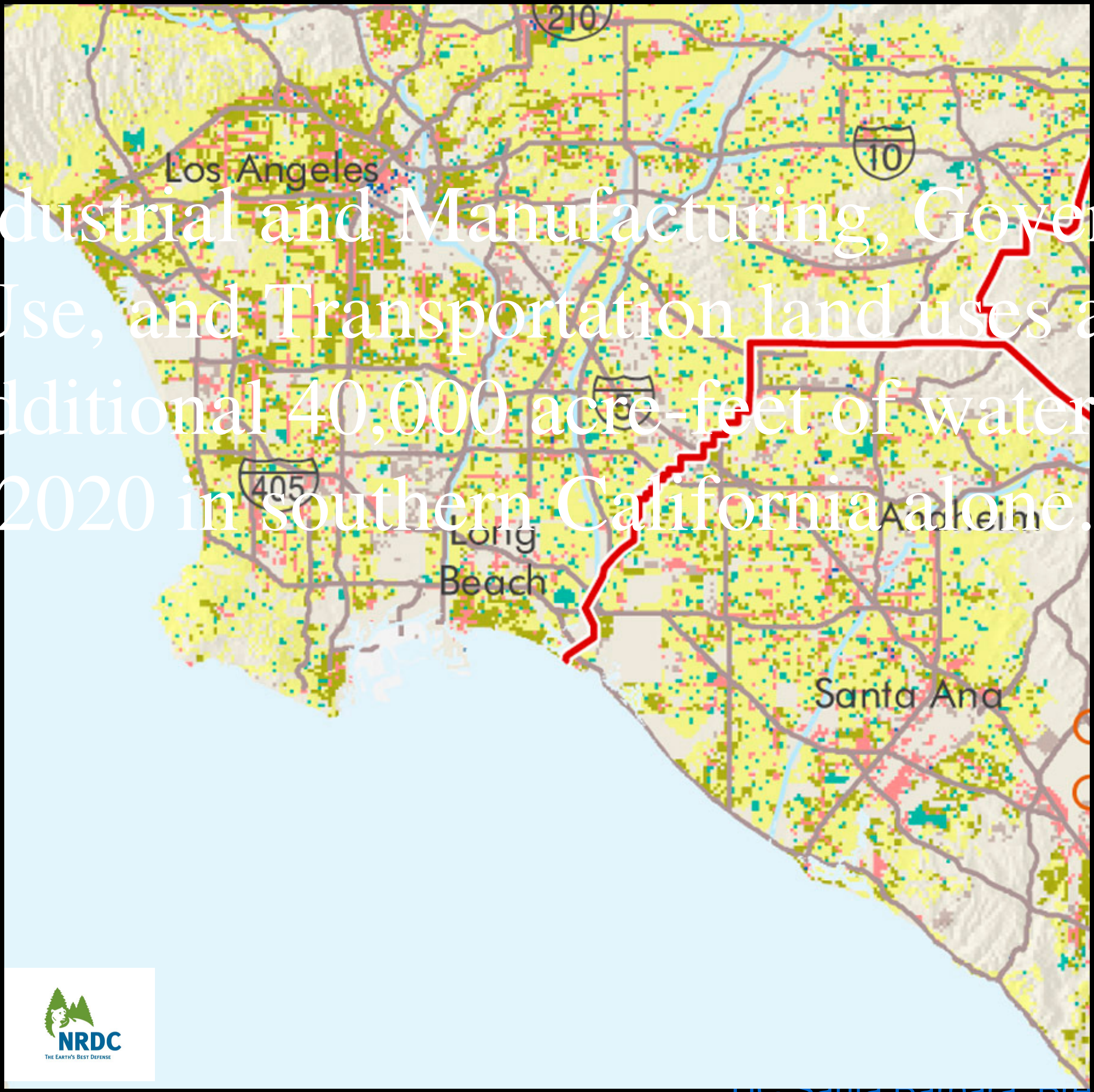
Land Use - Southern California



Light Industrial and Manufacturing, Government, Public Use, and Transportation land uses account for an additional 40,000 acre-feet of water per year by 2020 in southern California alone.

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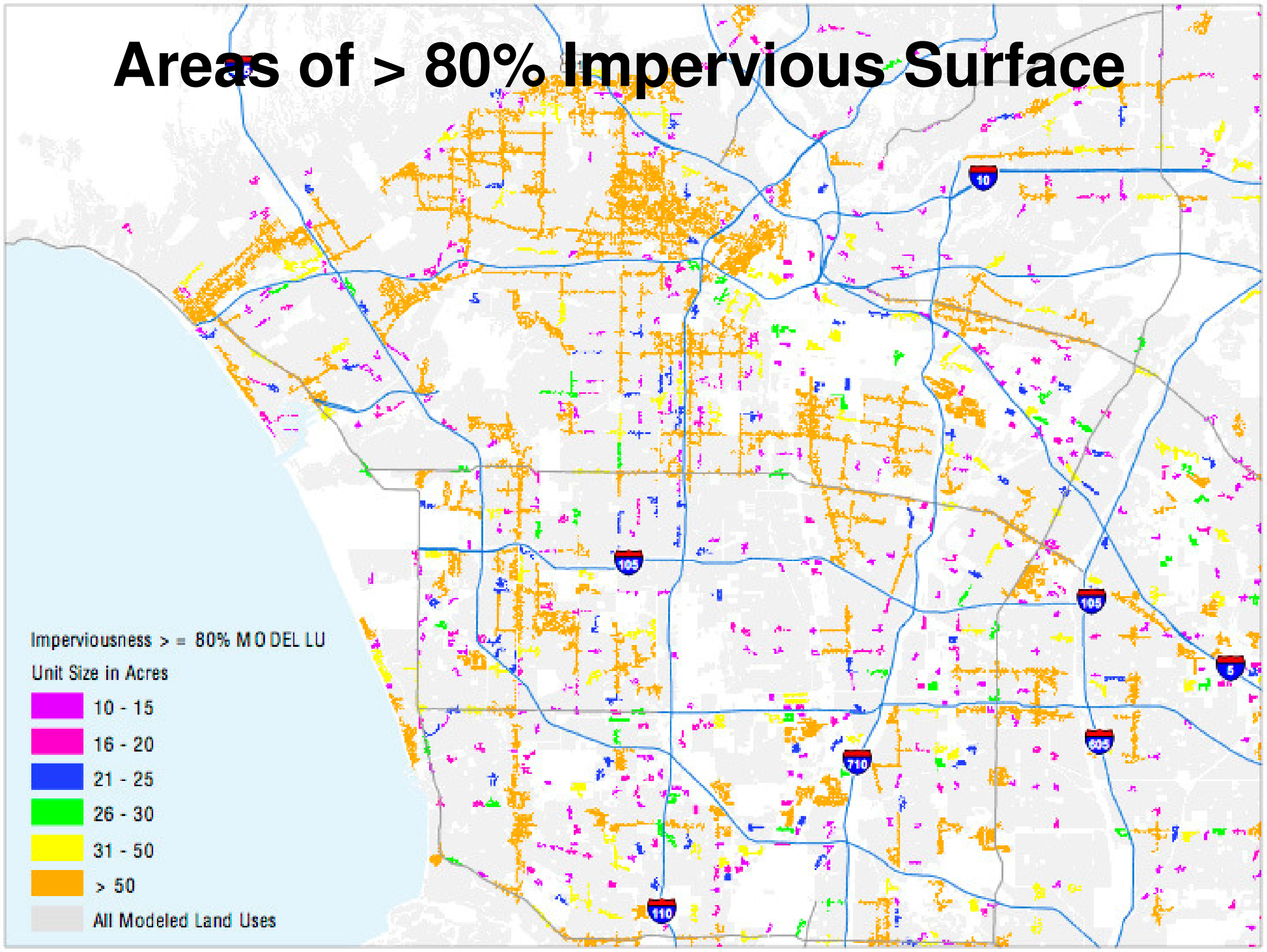
Impervious Surface - Los Angeles



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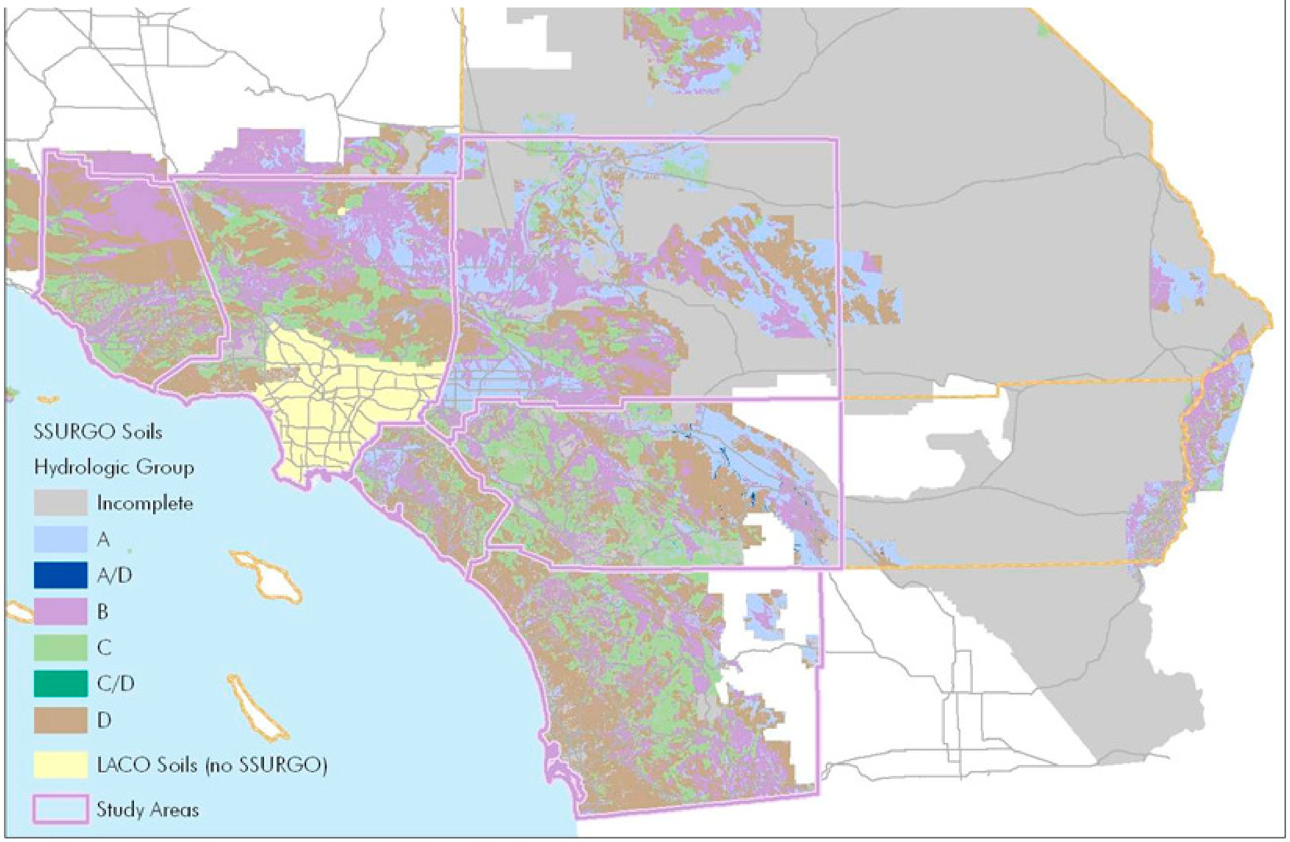
USDA Soil Classifications

A, B, and (with amendments) C Soils are suitable for infiltration



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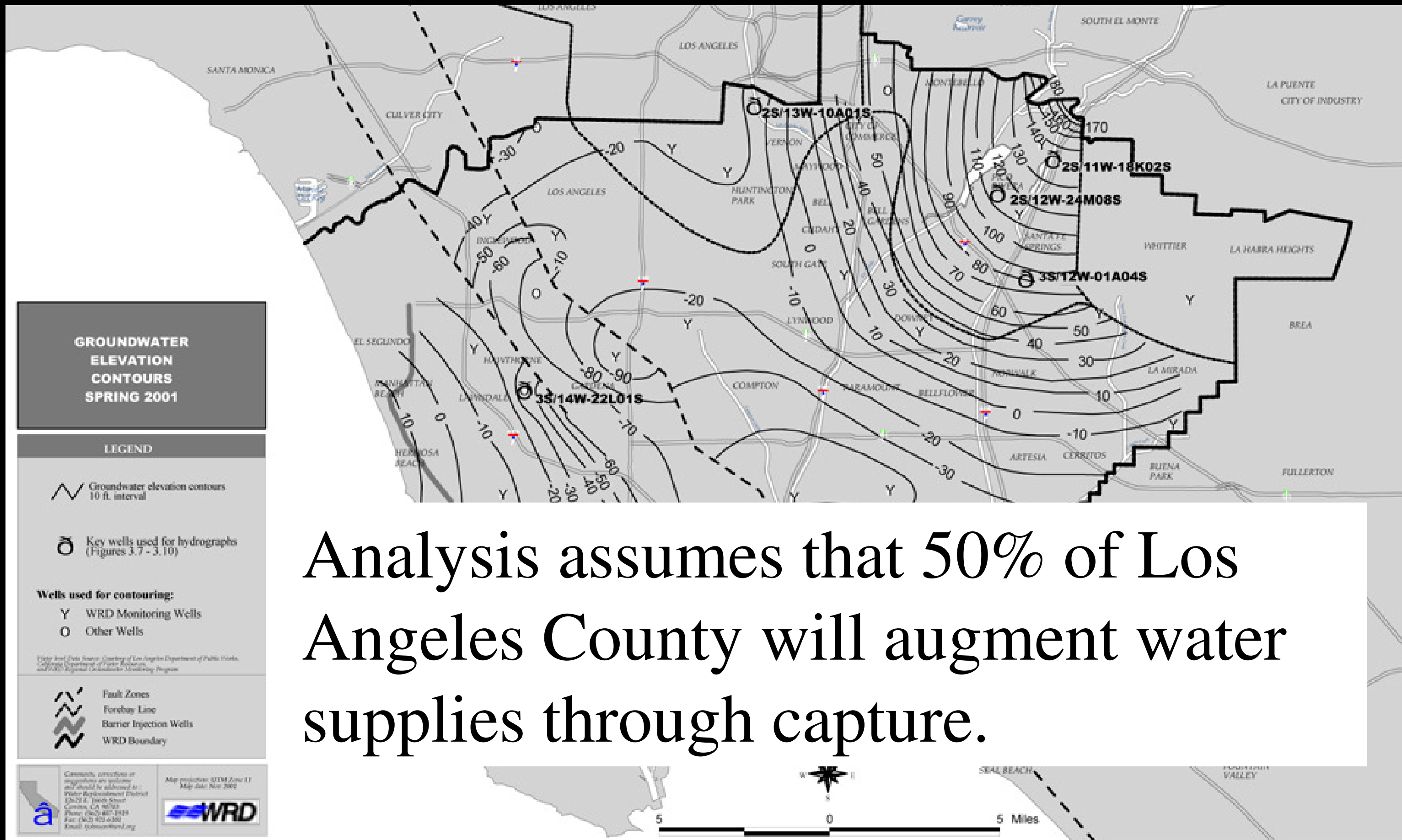
Shallow Groundwater/Contamination



Analysis assumes that 50% of Los Angeles County will augment water supplies through capture.

Water Reclamation District of Southern California

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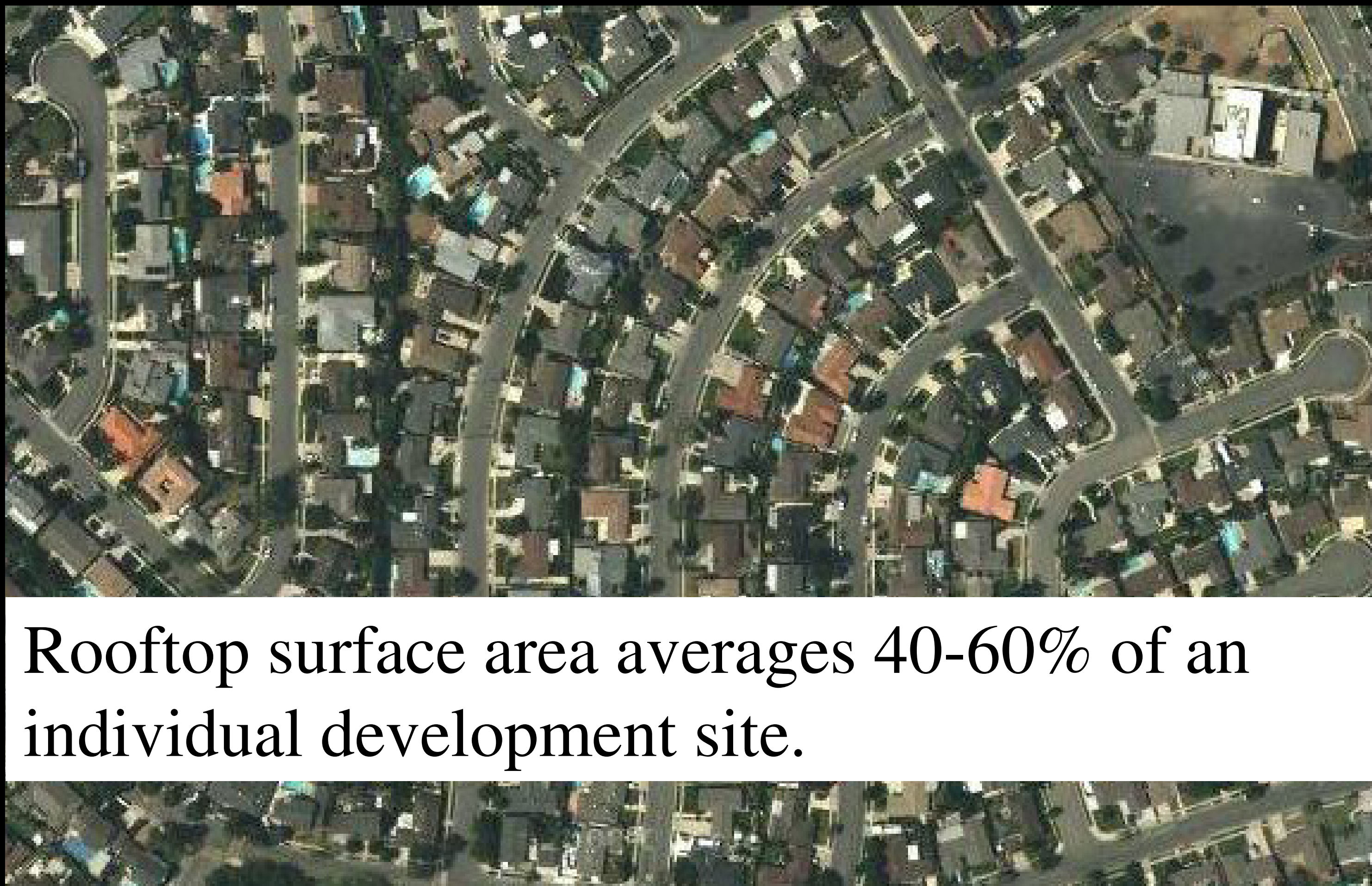
Rooftop Capture



Rooftop surface area averages 40-60% of an individual development site.

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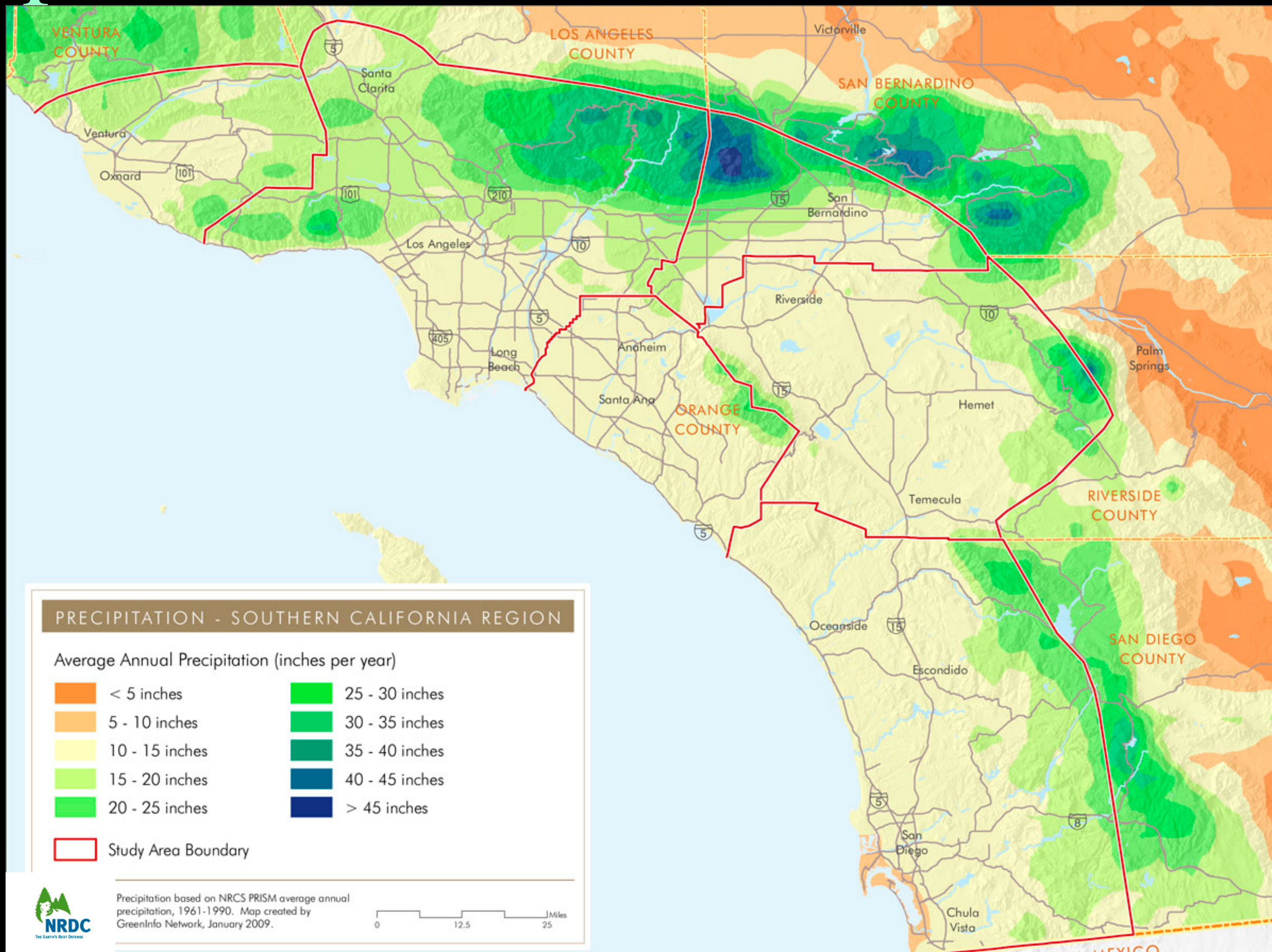
Precipitation in Southern California



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Data and Calculations

LAND USE GROUP	MEAN	2007 Acres	Est Imp Acres	Road Acres	Imp Acres w/o Roads	Avg Annual Precip	Annual Precip (acre-feet)	Post Development Impervious Runoff	Post-Development Total Runoff	Dry Weather Low Estimate	Est. Annual Acres development	Est. Acres New Development 2030	New Post Devel. Runoff 2030
A SOILS							**A SOILS**						
Colleges and Universities	29.37	535.42	157.26	44.64	112.62	18.72	765.75	166.93	173.30	83.89	7.34	168.71	52.60
Commercial Storage	57.44	166.37	95.55	22.80	72.75	14.25	170.47	82.07	82.97		2.28	52.42	25.86
Park-and-Ride Lots	53.48	21.15	11.31	1.67	9.65	13.80	22.40	10.53	10.66	2.18	0.29	6.66	3.32
Trailer Parks and Mobile Home Courts, High-Density	63.18	3,439.03	2,172.88	471.14	1,701.74	14.43	3568.61	1943.87	1990.01				
Under Construction	17.13	4,434.71	759.79	314.41	445.38	13.87	4760.76	488.88	617.56				
Wholesaling and Warehousing	72.41	5,778.79	4,184.54	446.39	3,738.15	14.22	6319.74	4208.79	4266.04		79.17	1820.90	1326.19
C SOILS							**C SOILS**						
Colleges and Universities	33.13	931.35	308.51	67.63	240.88	15.81	1137.63	301.41	397.42	138.18	12.76	293.47	94.98
Commercial Storage	56.65	57.81	32.75	7.18	25.57	15.31	64.59	30.99	34.73		0.79	18.22	9.76
Duplexes, Triplexes and 2-or 3-Unit Condominiums and Townhouses	35.13	113.17	39.76	15.15	24.61	18.05	147.42	35.16	48.08	16.29	1.12	25.77	8.01
High-Density Single Family Residential	37.14	30,098.22	11,177.70	4,944.38	6,233.32	17.28	36229.08	8528.95	11718.05	4197.53	297.97	6853.37	1942.04

Annual impervious runoff in 2020

Redevelopment by 2020:

0.152 gallons per minute per acre pervious surface

Calculate total impervious surface and rainfall generated runoff with high % impervious surface

- **70-75 years (100+ for office/university; 40 or less for retail sales), or 1.37% per year**
- **Commercial space based on estimated workforce expansion**

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Findings

Potential Savings in Urbanized Southern California and SF Bay Area by 2020 (increasing each year thereafter):

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Energy and GHG Benefits

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Energy Use for Water

California:

19%   electricity

33%   natural gas (non-power plant)

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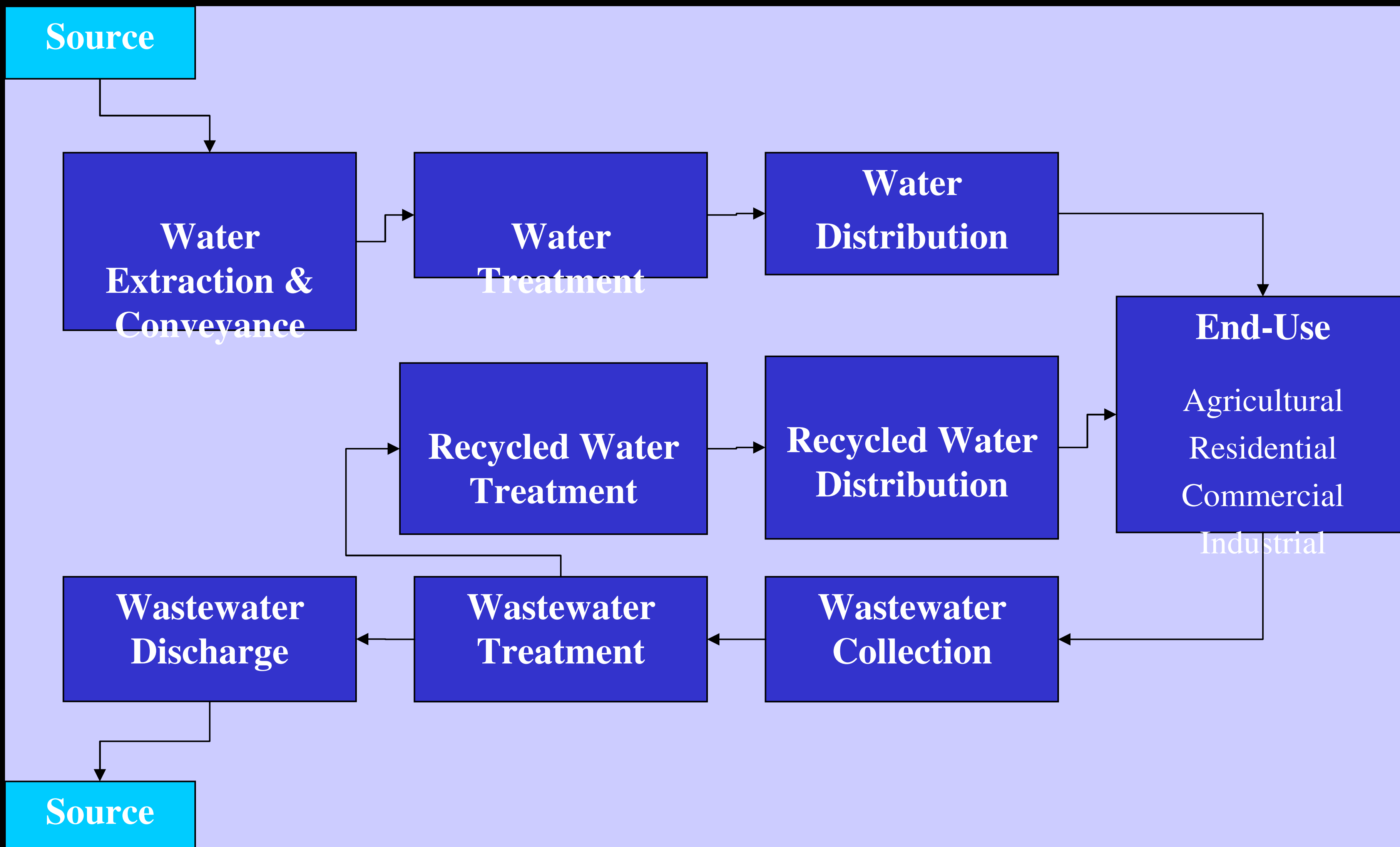
Energy Inputs to Water Systems



State Water Project

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SWP Pumping Facilities

Edmonston Pumping Plant

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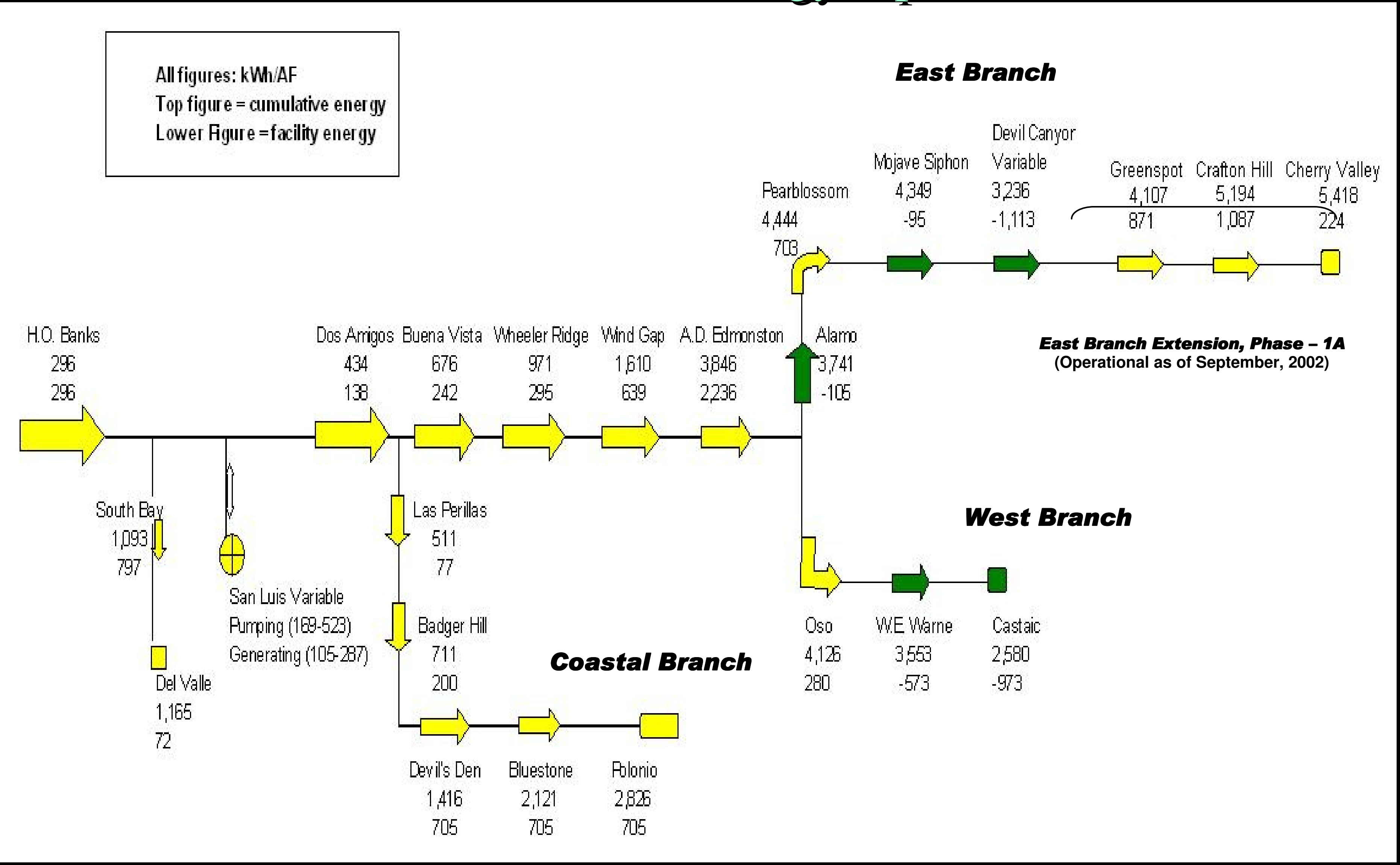
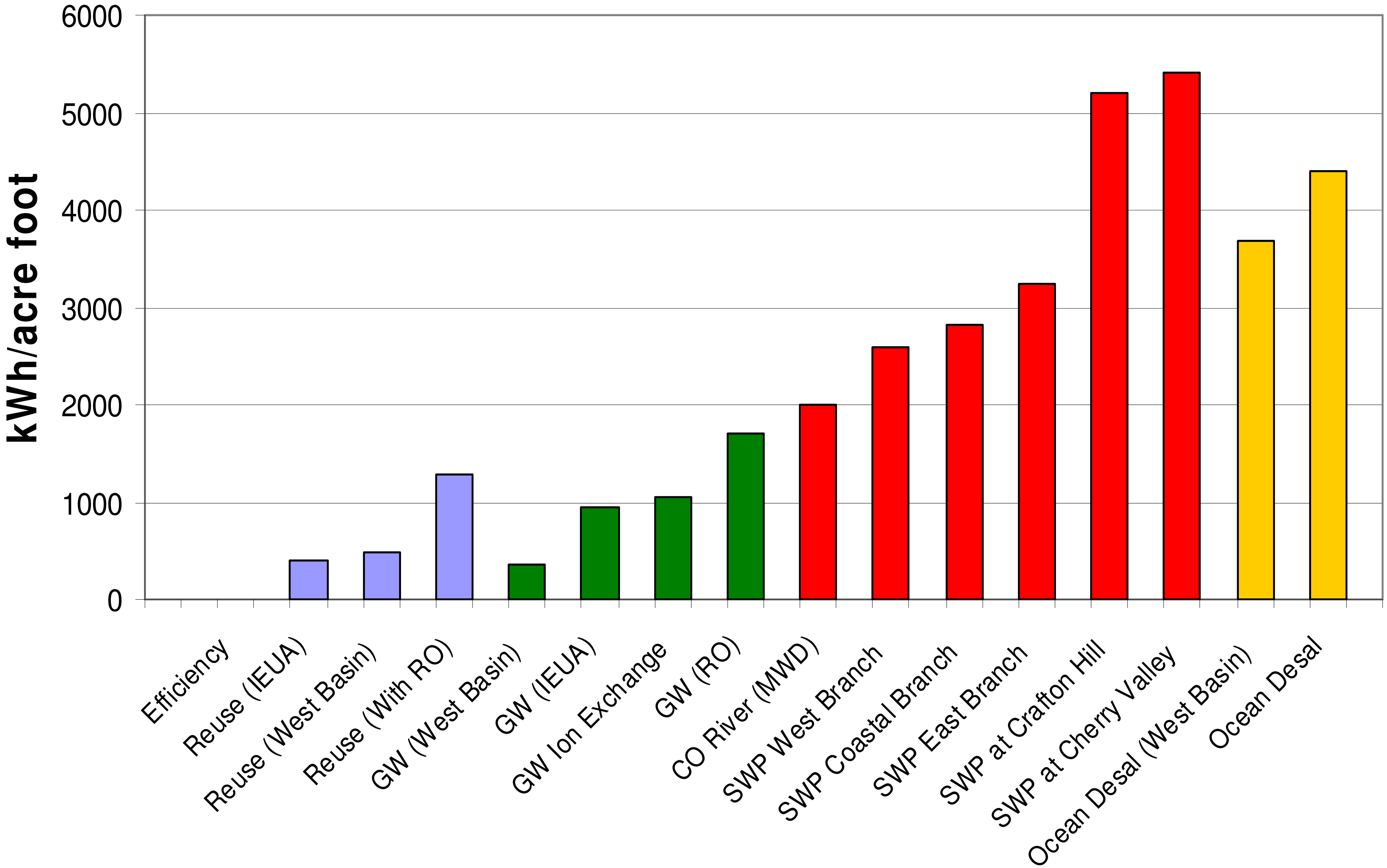
SWP Pumping Facilities

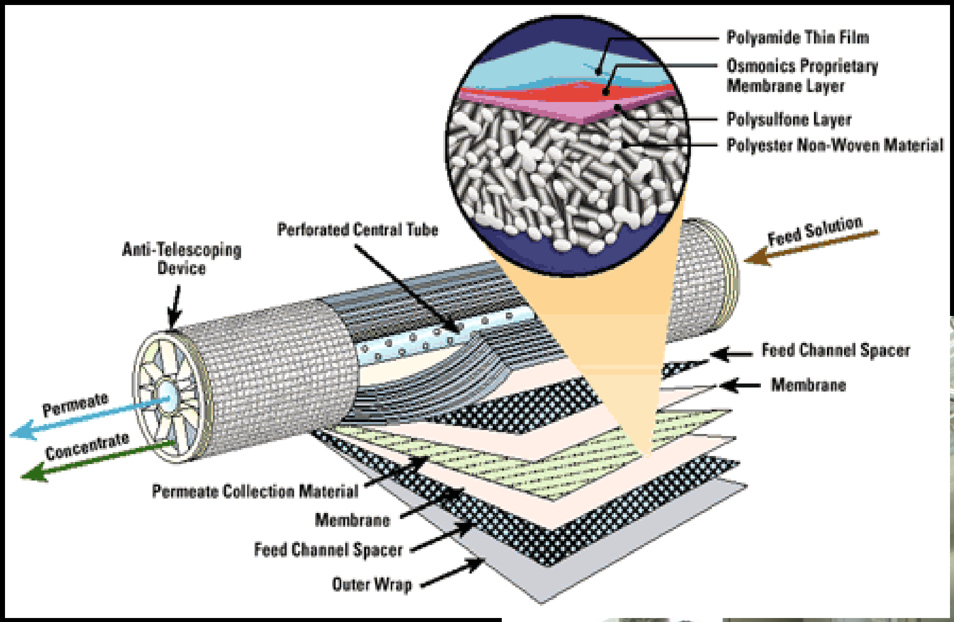
Incremental and Cumulative Energy Inputs and Generation



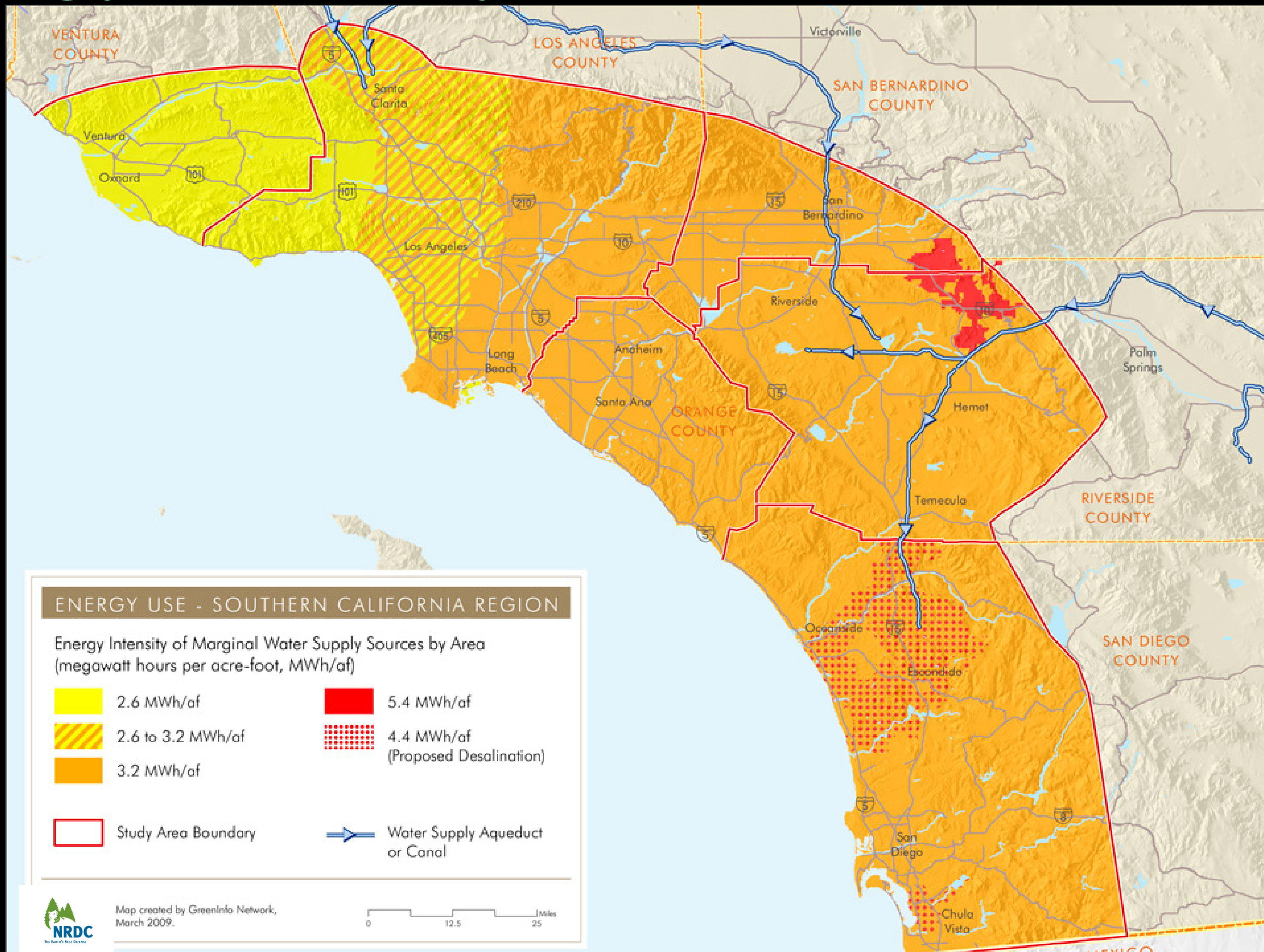
Energy Intensity of Selected Water Supply Sources in Southern California



Advanced Water Treatment



Energy Intensity



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Cost Efficient

National Association of Home Builders:

NAHB RESEARCH CENTER

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Ever wish you could simultaneously lower your site infrastructure costs, protect the environment, and increase your project's marketability? Using Low Impact Development (LID) techniques you can.

site.

Municipal Guide to Low Impact Development

Builder's Guide to Low Impact Development

LID has a variety of benefits to Builders, Municipalities, and the Environment such as:

- The reduction of land clearing and grading costs;
- Balancing the need for growth and environmental protection;
- The protection of local land and water resources.

LID utilizes a system of source controls and small-scale, decentralized treatment practices to help maintain a hydrologically functional landscape. The conservation of open space, the reduction of impervious surfaces, and the use of small-scale storm water controls, such as bioretention, are just a few of the LID practices that can help maintain predevelopment hydrological conditions.

Featured case study

Somerset is an 80-acre development in suburban Maryland consisting of 199 homes on 10,000 square foot lots. During Somerset's creation, the developer used LID practices to reduce its storm water management costs. By using LID, the developer:

- Eliminated the need for storm water ponds by using bioretention techniques saving approximately $300,000;
- Gained 6 additional lots and their associated revenues;
- Reduced finished lot cost by approximately $4,000.

For more information, download copies of the Builder's Guide to Low Impact Development and Municipal Guide to Low Impact Development brochures.

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Upper Marlboro, MD 20774
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